1256453

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

December 03, 2004

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: ***60/549,380***
FILING DATE: ***March 02, 2004***
RELATED PCT APPLICATION NUMBER: ***PCT/US04/35200***

Certified by

Jon W Dudas

Acting Under Secretary of Commerce
for Intellectual Property
and Acting Director of the U.S.
Patent and Trademark Office

PTO/SB/16 (10-01)
Approved for use through10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EV310450461US

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Paul L.	Scherzer	Midland, Texas

☐ *Additional inventors are being named on the ______ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

SYSTEM AND METHOD FOR PRODUCING ELECTRICITY USING NATURAL GAS

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☑ Customer Number 23380 *Type Customer Number here* → *Place Customer Number Bar Code Label here*

OR

☐ Firm or Individual Name					
Address					
Address					
City		State		ZIP	
Country		Telephone		Fax	

ENCLOSED APPLICATION PARTS *(check all that apply)*

☑ Specification *Number of Pages* 15
☑ Drawing(s) *Number of Sheets* 4
☐ Application Data Sheet. See 37 CFR 1.76
☐ CD(s), Number
☑ Other (specify) Express Mail Cert.

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☑ Applicant claims small entity status. See 37 CFR 1.27.
☑ A check or money order is enclosed to cover the filing fees
☑ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 50-0902
☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE AMOUNT ($): $80.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
☑ No.
☐ Yes, the name of the U.S. Government agency and the Government contract number are: __________

Respectfully submitted,

SIGNATURE [signature]

TYPED or PRINTED NAME John X. Garred

TELEPHONE 216-696-3340

Date 03/02/2004

REGISTRATION NO. *(if appropriate)* 31830

Docket Number: 10058/00003

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

18351

U.S. PTO

PTO/SB/17 (10-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

☑ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 80.00

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Paul L. Scherzer
Examiner Name	
Art Unit	
Attorney Docket No.	10058/00003

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☑ Deposit Account:

Deposit Account Number: 50-0902

Deposit Account Name: Tucker Ellis & West LLP

The Director is authorized to: *(check all that apply)*

☐ Charge fee(s) indicated below ☑ Credit any overpayments

☑ Charge any additional fee(s) or any underpayment of fee(s)

☐ Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	80.00

SUBTOTAL (1) ($) 80.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X		=	
Independent Claims		- 3** =		X		=	
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

***or number previously paid, if greater; For Reissues, see above*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ______

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($)

SUBMITTED BY			(Complete *(if applicable)*)		
Name (Print/Type)	John X. Garred	*Registration No. (Attorney/Agent)*	31,830	*Telephone*	216-696-3340
Signature	[signature]			*Date*	03/02/2004

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

MAIL CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that the attached U.S. Provisional Patent Application (along with any other paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on this date **March 2, 2004** in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number **EV310450461US** addressed to the: Mail Stop Provisional Patent Application, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450.

Valerie A. Salvino
(Typed or Printed Name of Person Mailing Paper)

Valerie A. Salvino

(Signature of Person Mailing Paper)

CLE 773589.1

SYSTEM AND METHOD FOR PRODUCING ELECTRICITY USING NATURAL GAS

Background of the Invention

The present invention generally relates to the generation of electricity using naturally occurring gas. More particularly, this invention is directed to a system and method for the generation of electricity using naturally occurring gas to drive a turbine and generator.

Electricity is vital to the economy and daily life due to the heavy reliance on devices that require electricity to function. Accordingly, a constant source of electricity sufficient to meet the ever-increasing demands of the consuming public is a critical component for daily operations. As the population has increased, the use of electricity-driven machines has also increased, thereby further increasing electricity demand. Such demand and general lack of supply has caused severe problems, including blackouts, power outages, brownouts, etc.

Several types of renewable energy sources are conventionally used for electricity and power generation. Hydroelectric power plants use water, either naturally flowing or forced through a dam, to drive large generators and account for roughly 9% of the U.S. energy production. However, the location of these plants is limited to those areas having naturally occurring bodies of water. Geothermal power plants use steam created by water and magma to generate electricity. However, locating and securing a constant source of steam thus generated is difficult and not widely available. Solar power, however, is becoming more prevalent as an alternative means for generating electricity. Photovoltaic cells directly translate solar energy into electricity. However, even the most advanced

photovoltaic cells do not exceed generally 15-20% efficiency and are only useful to the extent that sunlight is available.

Another source of renewable energy is wind power. Massive propellers, powered by the wind, rotate in large wind farms and generate electricity by driving generators. The use of wind power to generate electricity is becoming more common. However, similar to solar power, weather conditions can affect output and blackouts may occur due to slow wind periods. Still another source of renewable energy that has not seen great production of electricity is the use of biomass to fire boilers, thereby generating steam. Biomass generally includes wood, agriculture, biological wastes and other refuse that may be burned in large furnaces for generating the heat necessary to create steam for powering turbine generators.

Turbines are frequently used to generate electricity. In general, a turbine translates a received force into a rotational energy. The rotational energy is then transferred to an associated generator that translates the rotational energy into a raw form of electricity available to a transformer or other suitable device for consumption and use.

The force received by the turbine is any of a suitably plurality of forces, such as a steam force. A steam force suitably is generated by burning a fuel in a furnace, thereby converting water to steam. The steam is transferred to the turbine where it causes a turbine fan to rotate and thereby generate the rotational energy. The fuel burnt in the furnace is any of a suitable plurality of fuels, including flammable natural gas, petroleum, oil, coal, etc. However, most suitable fuels are non-renewable natural resources. Accordingly, there is a need for a system and method for generating electricity that more efficiently utilizes fuel.

Summary of the Invention

In accordance with the present invention, disclosed is a system and method for more efficiently producing electricity through the use of natural gas.

In accordance with one aspect, the present invention teaches a system for using natural gas to produce electricity. The system includes a well adapted for withdrawing pressurized natural gas, such as a flammable natural gas, from a naturally occurring source of natural gas. The pressurized natural gas is used to drive a turbine and an associated generator to produce electricity. Additionally, the pressurized natural gas used to drive the turbine is suitably recovered and used to drive additional turbines and associated generators.

In one embodiment, the system is adapted to use natural gas containing little or no amounts of carbon dioxide and/or nitrogen. According to another embodiment, the system is adapted to use natural gas containing large amounts of carbon dioxide and/or nitrogen. The system suitably includes a separator adapted for separating the carbon dioxide and/or nitrogen from the natural gas before the natural gas is used by the additional turbine and generator to produce electricity.

In accordance with yet another aspect, the present invention teaches a method for using natural gas to produce electricity. The method generally includes the steps of withdrawing pressurized natural gas from a well, driving a turbine with the pressurized natural gas, driving a generator associated with the turbine and generating electricity through the driving of the generator. The method suitably also includes the steps of transferring the natural gas from the turbine and driving additional turbines and

generators to produce additional energy. The method is adapted to be implemented with natural gas containing either little or large amounts of nitrogen and/or carbon dioxide.

These and other aspects, features and advantages will be understood by one skilled in the art upon reading the specification.

Brief Description of the Drawings

The accompanying figures incorporated in and forming a part of the specification, illustrate several aspects of the present invention, and together with the description serve to explain the principles of the invention. In the figures:

Figure 1 generally illustrates an example configuration of components of the electricity-generating system of the present invention;

Figure 2 generally illustrates an example of an alternate configuration of components of the electricity-generating system of the present invention;

Figure 3 is flowchart illustrating an example of a method of the present invention; and

Figure 4 is flowchart illustrating an alternate example of a method of the present invention

Detailed Description of Preferred Example Embodiments of the Present Invention

The present invention is directed to a system and method for using natural gas to generate electricity. In general, energy is generated by directing the flow pressure of a naturally occurring deposit of natural gas to drive a turbine and generator. Upon driving the turbine and generator, the natural gas is suitably recovered and sent to a transmission

pipeline for delivery to end users or is suitably used to drive at least one additional turbine and generator. Accordingly, the system is adapted to use the natural gas at least once to generate electricity before the natural gas is delivered for subsequent use and/or sale. The system and method are adapted to use both natural gas containing a small or no amount of nitrogen or carbon dioxide and natural gas containing a large amount of nitrogen or carbon dioxide.

With reference to Figure 1, illustrated is an example embodiment of the system 100 for using natural gas to generate electricity. The system 100 includes a source (not shown) of natural gas, such as a naturally occurring deposit or reservoir of natural gas under pressure, as known to one of ordinary skill in the art. The example system 100 of Figure 1 is adapted for using a source of natural gas containing small or no amounts of nitrogen or carbon dioxide. The natural gas is suitably a flammable natural gas.

A well 102 or other suitable device is installed in an area near the source of the natural gas for accessing and withdrawing the natural gas in a controlled manner, the structure and manner of installation of which is known to one of ordinary skill in the art. The well 102 includes a wellhead 104 that operates as a conduit through which the natural gas flows and has affixed thereto a cutoff valve (not shown) adapted for maintaining the natural gas at a level of pressure and for providing safety features.

A pipe 106 is coupled to the wellhead 104 for transporting the natural gas to a turbine 108. The pipe 106 is suitably adapted for maintaining the pressure of the natural gas as received from the source and delivering the natural gas under pressure to the turbine 108, and is composed of any material suitable for handling the high pressures and low temperatures associated with the natural gas, such as steel, polyvinyl chloride (PVC),

etc. Given the pressure of the transported gas, one of ordinary skill in the art will understand that the pipe 106 is of any suitable diameter as determined by various properties of the natural gas and the desired resultant effect of the transported natural gas.

The pipe 106 transports the natural gas under pressure to the turbine 108. In general, the turbine 108 is adapted to receive the pressurized natural gas, translate the pressure into a rotational energy and transfer the rotational energy to an associated generator for subsequent use by the generator in producing electricity.

The pipe 106 generally releases the pressurized natural gas into an internal cavity 110 of the turbine 108. The turbine 108 is suitably a sealed container adapted to prevent leakage of the natural gas out of the turbine. The internal cavity 110 includes a turbine fan 112 that is adapted to rotate in response to the input pressurized natural gas. The fan 112 is communicatively coupled to an elongate shaft-like cylindrical member 114 that communicates with the generator 116. The fan 112 is coupled to the shaft 114 in such a manner that the rotation of the fan 112 causes the shaft 114 to similarly rotate.

The shaft 114 of the turbine 108 is generally communicatively coupled to a rotor 118 of the generator 116. The rotation of the shaft 114 imparts a rotational energy to the generator rotor 118, which rotational energy is subsequently harnessed by the generator 116 to produce electricity, as known to one of ordinary skill in the art. The produced electricity is transmitted from the generator 116 via an electricity transmission line 120 to a transformer 122. In general, the transformer 122 is adapted for stepping up the voltage of the electricity received from the generator 116 so that the electricity is in a form suitable for transmission along a high voltage line 124, thereby making the electricity available to substations (not shown) and ultimately consuming devices. The generator

116 is also suitably adapted to transmit an amount of the generated electricity to an alternate transformer 117 for subsequent on-site usage.

Returning to the turbine 108, the turbine suitably includes a pipe-like conduit 124 adapted for releasing the natural gas that already acted on the turbine fan 112 to a gas transmission pipeline 126 for subsequent delivery of the natural gas to another location. The conduct 124 suitably includes a selectable valve-like diverter 128 for redirecting the natural gas to a second turbine and generator system, such as a steam-driven turbine and generator system, which is also adapted for using the natural gas to produce electricity.

With further reference to Figure 1, the flow of the natural gas suitably passes from the conduit 124 and valve 128 to a furnace 130 upon appropriate orientation of the valve 128. The furnace 130 is generally adapted to burn the received natural gas as a fuel, thereby converting water into steam. The generated steam travels from the furnace 130 via a steam conduit 132 to a turbine 134. In general, the turbine 134 is a steam-driven turbine such that the turbine 134 is adapted to receive and translate a steam force. The received steam acts on a turbine fan 136 housed within the turbine 134. The fan 136 rotates in response thereto and imparts a rotational force onto an elongate shaft-like cylindrical member 138, as previously described. A rotor 140 housed within a generator 142 associated with the turbine 134 is communicatively coupled to the shaft 138, such that the rotation of the shaft 138 causes the rotor 140 to similarly rotate and generate electricity thereby, as also previously described. The generated electricity is transferred via an electricity transmission line 144 to a transformer 146 for preparing the electricity for subsequent transmission to the high voltage line 124. The generator 142 is suitably

adapted to transmit an amount of the generated electricity to an alternate transformer 148 for subsequent on-site usage.

Thus, the system 100 as described hereinabove suitably enables a quantity of natural gas to be used more than once in generating electricity. Figure 1 illustrates the system 100 as adapted to pass a quantity of natural gas through two turbine and generator systems, thereby producing more electricity than if only one turbine and generator system were used. It will be appreciated that the system 100 is scalable such that more than two turbine and generator systems are suitably implemented to further increase the amount of electricity generated with a quantity of natural gas.

Depending on the particular configuration and layout of the system 100, the system 100 suitably includes at least one compressor for maintaining a level of pressure of the natural gas within the system 100. For example, a compressor 150 is suitably integrated with the pipe 106 for ensuring that the natural gas is delivered to the turbine 108 under pressure. As another example, a compressor 152 is suitably integrated with the conduit 124 at a location upstream of the valve 128 for delivering the natural gas under pressure to the furnace 130. As yet another example, a compressor 154 is suitably integrated with the conduit 124 at a location downstream of the valve 128 for delivering the natural under pressure to the gas transmission pipeline 126. The system 100 suitably also includes one or more chokes adapted for reducing flow pressure. In a preferred embodiment, a first choke 156 is integrated with the pipe 106 and a second choke 158 is integrated with the conduit 124 upstream of the valve 128.

The system 100 suitably also includes a bypass pipeline 160 adapted for transmitting natural gas from the well 102 directly to the conduit 124, thereby bypassing

entry into the turbine 108 and generator 116. The bypass pipeline 160 is integrated with the conduit 124 at any suitable location, such as upstream from the valve 128 or downstream from the valve 128. The bypass pipeline 160 suitably includes at least one cutoff valve for controlling the flow of the natural gas through the pipeline 160.

The system is also adapted to have a separator 162 integrated with the conduit at a location upstream of the valve 128. The separator 162 is adapted to receive natural gas containing nitrogen or carbon dioxide and separate the nitrogen or carbon dioxide from the natural gas.

Turning to Figure 2, illustrated is an example system 200 adapted for using natural gas containing a large amount of nitrogen or carbon dioxide to produce electricity. The system 200 is of any suitable configuration, such as the configuration as depicted in Figure 1. The system 200 generally includes similar components as those which comprise the system 100 of Figure 1. Accordingly, as appropriate, an abbreviated discussion of such components will follow with regard to Figure 2.

The system 200 includes a source (not shown) of natural gas, such as a flammable natural gas, containing large amounts of nitrogen or carbon dioxide. A well 202 or other suitable device is installed in an area near the source of the natural gas for accessing and withdrawing the natural gas in a controlled manner. The well 202 includes a wellhead 204 that operates as a conduit through which the natural gas flows and has affixed thereto a cutoff valve (not shown) adapted for maintaining the natural gas at a level of pressure and for providing safety features.

A pipe 206 is coupled to the wellhead 204 for transporting the natural gas to a turbine 208. The pipe 106 suitably releases the pressurized natural gas into an internal

cavity 210 of the turbine 208. The turbine 208 suitably is a sealed container adapted to prevent leakage of the natural gas out of the turbine and includes a turbine fan 212 adapted to rotate in response to the input pressurized natural gas. The fan 212 is communicatively coupled to an elongate shaft-like cylindrical member 214 that communicates with the generator 216 in such a manner that the rotation of the fan 212 causes the shaft 214 to similarly rotate.

The shaft 214 of the turbine 208 is generally communicatively coupled to a rotor 218 housed by the generator 216. The rotation of the shaft 214 imparts a rotational energy to the generator rotor 218, which rotational energy is subsequently harnessed by the generator to produce electricity, as known to one of ordinary skill in the art. The produced electricity is transmitted from the generator 216 via an electricity transmission line 220 to a transformer 222 for processing the electricity into a form suitable for transmission along a high voltage line 224. The generator 216 is also suitably adapted to transmit an amount of the generated electricity to an alternate transformer 217 for subsequent on-site usage.

Returning to the turbine 208, the turbine suitably includes a pipe-like conduit 224 adapted for releasing the natural gas that already acted on the turbine fan 212 to a separator 228 that is adapted for separating the nitrogen and/or carbon dioxide from the natural gas, the operation and structure of which is known to one of ordinary skill in the art. Accordingly, the separator has associated therewith at least two outlets, a nitrogen/carbon dioxide pipeline 230 and a natural gas conduit 232.

The nitrogen/carbon dioxide pipeline 230 suitable accepts the nitrogen and/or carbon dioxide separated from the natural gas and delivers it to a nitrogen/carbon dioxide

transmission pipeline 234 that transmits the nitrogen and/or carbon dioxide to an additional location for subsequent use and/or sale. The pipeline 230 suitably includes a vent 236, controllable by a valve (not shown), adapted for releasing to the atmosphere at least a portion of the nitrogen and/or carbon dioxide that passes through the pipeline 230.

The separator 228 also includes the natural gas conduit 232 for receiving the separated natural gas and delivering the natural gas to another turbine and generator system, as described previously with regard to Figure 1, or to a natural gas transmission pipeline 226 for transportation to another location. The conduct 232 suitably includes a selectable valve-like diverter 235 for directing the natural gas to either the turbine and generator or to the pipeline 226. When the natural gas is delivered to the turbine and generator, it first enters a furnace 238 where it is used as fuel to transform water into steam. The generated steam passes through a steam conduit 240 to a turbine 242. In general, the turbine 242 is a steam-driven turbine such that the steam acts on a turbine fan 244 housed within the turbine 242. The fan 244 rotates in response thereto and imparts a rotational force onto an elongate shaft-like cylindrical member 246, as previously described. A rotor 248 housed within a generator 250 associated with the turbine 242 receives the rotational force of the shaft 246 and generates electricity thereby. The generated electricity is transferred via an electricity transmission line 252 to a transformer 254 for preparing the electricity for subsequent transmission to the high voltage line 224. The generator 250 is suitably adapted to transmit an amount of the generated electricity to an alternate transformer 256 for subsequent on-site usage.

Thus, the system 200 as described hereinabove suitably enables a quantity of natural gas to be used more than once in generating electricity. Figure 2 illustrates the

system 200 as adapted to pass a quantity of natural gas through two turbine and generator systems, thereby producing more electricity than if only one turbine and generator system were used. Accordingly, it will be appreciated that the system 200 is scalable such that more than two turbine and generator systems may be implemented to further increase the amount of electricity generated with a quantity of natural gas.

Depending on the particular configuration and layout of the system 200, the system 200 suitably includes at least one compressor for maintaining a level of pressure of the natural gas within the system 200. For example, a compressor 258 is suitably integrated with the pipe 206 for ensuring that the natural gas is delivered to the turbine 208 under pressure. As another example, a compressor 260 is suitably integrated with the conduit 224 at a location upstream of the separator 228 for delivering the natural gas under pressure to the separator 228. As yet another example, a compressor 262 is suitably integrated with the conduit pipeline 232 at a location downstream of the separator 228 for delivering the natural gas under pressure to the gas transmission pipeline 226 or the furnace 238. As yet another example, a compressor 263 is suitably integrated with the pipeline 230 at a location either upstream or downstream of the vent 236. The system 200 suitably also includes one or more chokes adapted for reducing flow pressure. In a preferred embodiment, a first choke 264 is integrated with the pipe 206, a second choke is 266 integrated with the conduit 224 upstream of the separator 228, and a third choke 268 is associated with the pipeline 232.

The system 200 suitably also includes a bypass pipeline 270 adapted for transmitting natural gas from the well 202 directly to the conduit 224, thereby bypassing entry into the turbine 208 and generator 216. The bypass pipeline 270 is integrated with

the conduit 224 at a suitable location upstream from the separator 228. The bypass pipeline 270 suitably includes at least one cutoff valve for controlling the flow of the natural gas through the conduit 224.

Additionally disclosed according to the present invention is a method for using natural gas containing little or no amounts of carbon dioxide and/or nitrogen to produce electricity. The method is generally implemented through the system 100 discussed above. Accordingly, an abbreviated discussion of the structure and function of the system on which the method is implemented will follow. With reference to Figure 3, the method 300 is initiated by locating a source of pressurized natural gas and installing a well thereon in step 304. Once the well has been installed, natural gas is withdrawn from the well at step 306 and then delivered to a turbine at step 308. As previously described with reference to the system 100, the pressure of the natural gas drives the turbine at step 310, which driving results in a rotational force being generated. At step 312, the rotational force is transferred from the turbine to the generator, wherein the generator harnesses the rotational force to generate electricity at step 314. Once the electricity has been generated, it is suitably either stored at step 316 for future usage or is suitably transmitted at step 318 to an additional site.

Returning to the step 310 wherein the natural gas drives the turbine, the method 300 is adapted to retrieve, at step 320, the natural gas from the turbine once the natural gas has driven the turbine, as previously described. Once the natural gas has been retrieved, it is suitably either delivered to a transmission pipeline at step 322 for delivery to an additional location or is suitably delivered to a furnace at step 324. After delivery to the furnace, the natural gas is consumed and thereby produces steam. The steam is

delivered to a second turbine at step 326. The steam drives the second turbine at step 328 and the rotational force generated thereby is transferred to a second generator at step 330. The generator harnesses the rotational energy to generate electricity at step 332. The generated electricity is suitably either stored at step 334 or is suitably transmitted at step 336 to another location. One of ordinary skill in the art will appreciate that a more detailed understanding of the method is understandable with a reading of the discussion of the system 100.

Additionally disclosed according to the present invention is a method for using natural gas containing large amounts of carbon dioxide and/or nitrogen to produce electricity. The method is generally implemented through the system 200 discussed above. Accordingly, an abbreviated discussion of the structure and function of the system on which the method is implemented will follow. With reference to Figure 4, the method 400 is initiated by locating a source of pressurized natural gas and installing a well thereon in step 404. Once the well has been installed, natural gas is withdrawn from the well at step 406 and then delivered to a turbine at step 408. As previously described with reference to the system 200, the pressure of the natural gas drives the turbine at step 410, which driving results in a rotational force being generated. At step 412, the rotational force is transferred from the turbine to the generator wherein the generator harnesses the rotational force to generate electricity at step 414. Once the electricity has been generated, it is suitably either stored at step 416 for future usage or is suitably transmitted at step 418 to an additional location.

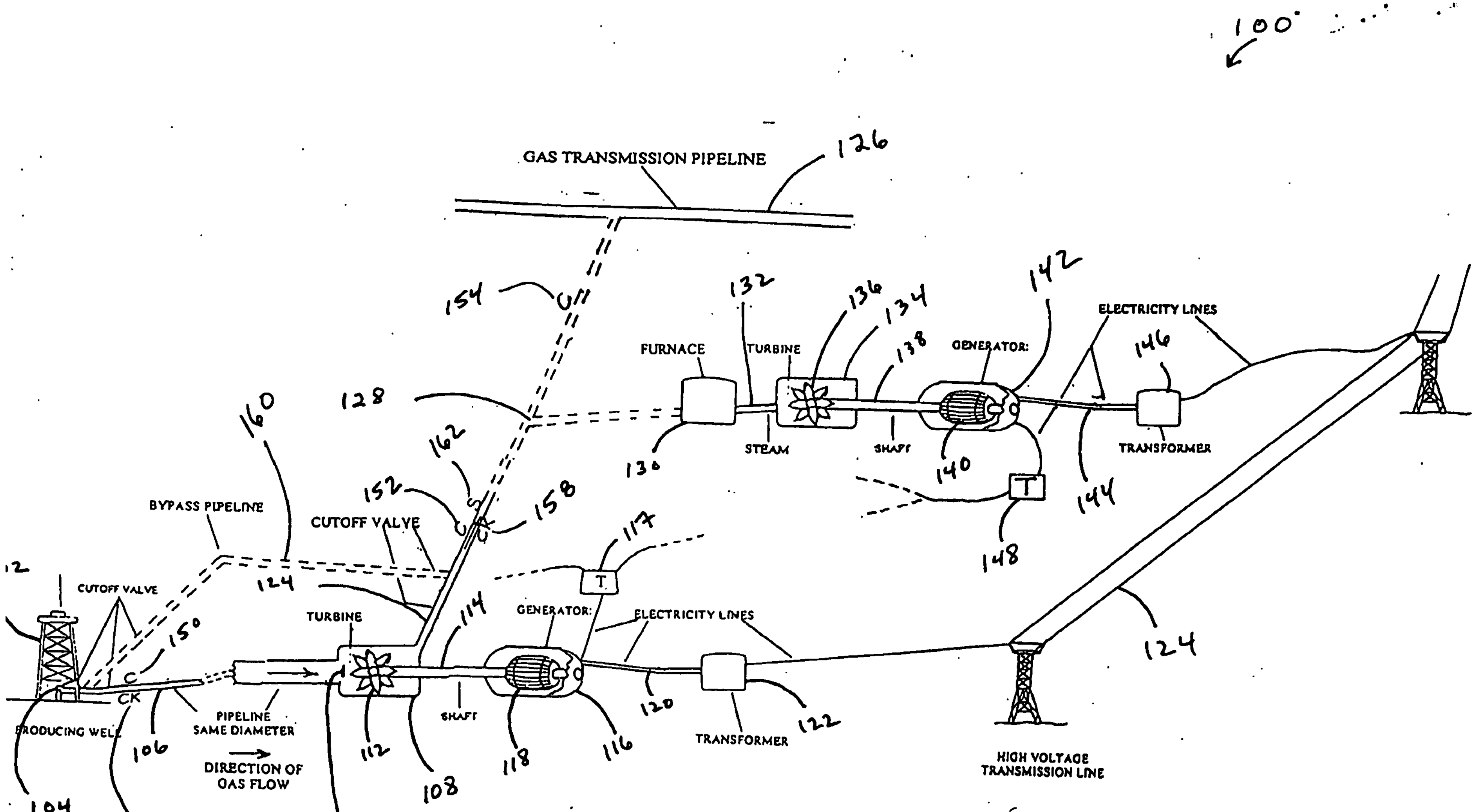
Returning to the step 410 wherein the natural gas drives the turbine, the method 400 is adapted to retrieve, at step 420, the natural gas from the turbine once the natural

gas has driven the turbine, as previously described. Once the natural gas has been retrieved, it is suitably delivered to a separator at step 422, which separator is adapted to separate the natural gas from the carbon dioxide and/or nitrogen. Once the carbon dioxide and/or nitrogen has been separated, it is delivered to a transmission pipeline at step 424 for transmission to another location. Once the natural gas has been separated from the carbon dioxide and/or nitrogen, it is delivered to a conduit at step 426. Once in the conduit, the natural gas is delivered suitably to either a natural gas transmission pipeline at step 428 for delivery to another location or to a furnace at step 430 for additional electricity generation. The natural gas is consumed in the furnace as described above and the resultant steam is delivered to a second turbine at step 432 where it is used to drive the second turbine at step 434. The rotational force generated thereby is transferred to a second generator at step 436 where it is used to generate electricity at step 438. The generated electricity is suitably either stored at step 440 or is suitably transmitted at step 442 to another location. One of ordinary skill in the art will appreciate that a more detailed understanding of the method is understandable with a reading of the discussion of the system 200.

Although the preferred embodiments have been described in detail, it should be understood that various changes, substitutions and alterations can be made therein without departing from the spirit and scope of the invention as defined by the appended claims. It will be appreciated that various changes in the details, materials and arrangements of components, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as will be expressed in the appended claims.

Abstract

A system and method for using natural gas to generate electricity. Natural gas under pressure is withdrawn from a well and passed to a turbine. The pressure of the natural gas acts on a turbine fan that in turn drives a generator to generate electricity. The natural gas used to drive the turbine fan suitably is reused to drive another turbine and generator, thereby producing additional electricity.



POSSIBLE EQUIPMENT SITES
C COMPRESSOR
S SEPARATOR
CK CHOKE
T TRANSFORMER (onsite usage)

DIRECTION OF GAS FLOW

FIGURE 1

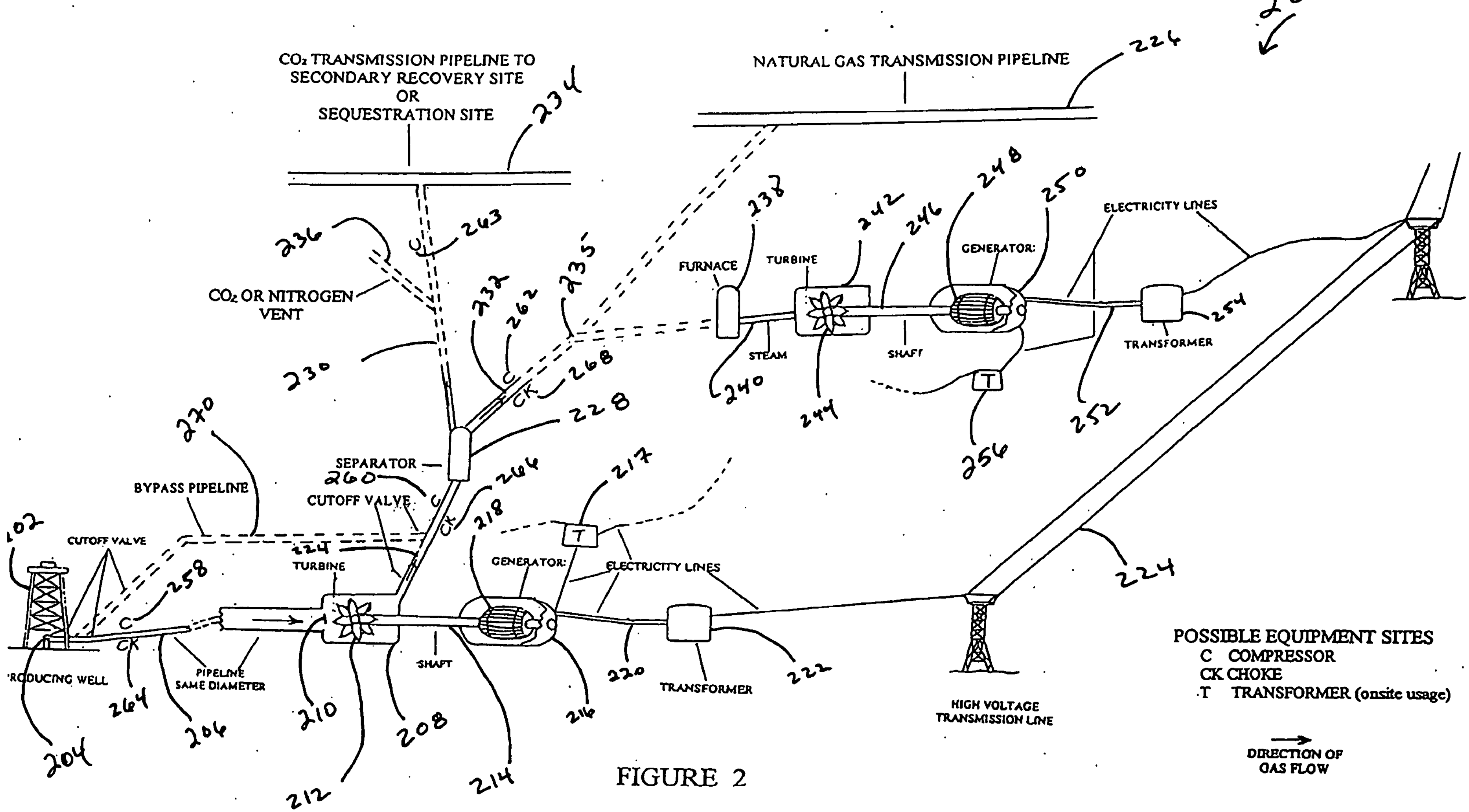

200
CO2 TRANSMISSION PIPELINE TO
SECONDARY RECOVERY SITE
OR
SEQUESTRATION SITE
234
NATURAL GAS TRANSMISSION PIPELINE
226
236
243
CO2 OR NITROGEN
VENT
230
232
262
235
268
CK
228
FURNACE
238
TURBINE
242
246
248
GENERATOR:
250
ELECTRICITY LINES
STEAM
SHAFT
240
244
T
256
252
TRANSFORMER
254
270
BYPASS PIPELINE
SEPARATOR
260
CUTOFF VALVE
264
218
217
T
102
CUTOFF VALVE
224
TURBINE
258
C
GENERATOR:
ELECTRICITY LINES
CK
PRODUCING WELL
PIPELINE
SAME DIAMETER
SHAFT
264
206
210
208
212
214
216
220
TRANSFORMER
222
204
224
HIGH VOLTAGE
TRANSMISSION LINE
POSSIBLE EQUIPMENT SITES
C COMPRESSOR
CK CHOKE
T TRANSFORMER (onsite usage)
DIRECTION OF
GAS FLOW

FIGURE 2

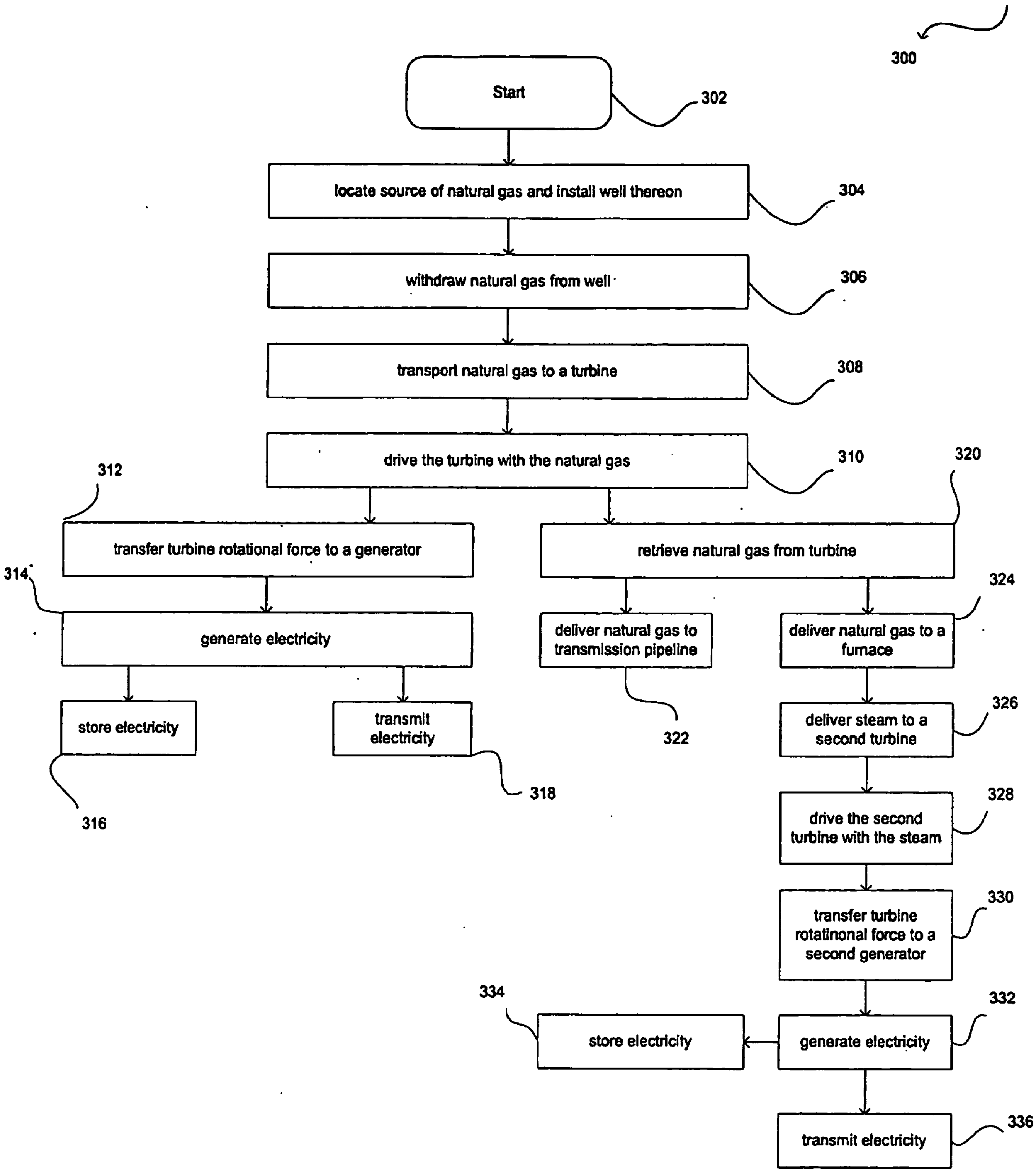

300
Start
302
locate source of natural gas and install well thereon
304
withdraw natural gas from well
306
transport natural gas to a turbine
308
drive the turbine with the natural gas
310
312
transfer turbine rotational force to a generator
314
generate electricity
store electricity
316
transmit electricity
318
320
retrieve natural gas from turbine
deliver natural gas to transmission pipeline
322
deliver natural gas to a furnace
324
deliver steam to a second turbine
326
drive the second turbine with the steam
328
transfer turbine rotatinonal force to a second generator
330
generate electricity
332
store electricity
334
transmit electricity
336

Figure 3

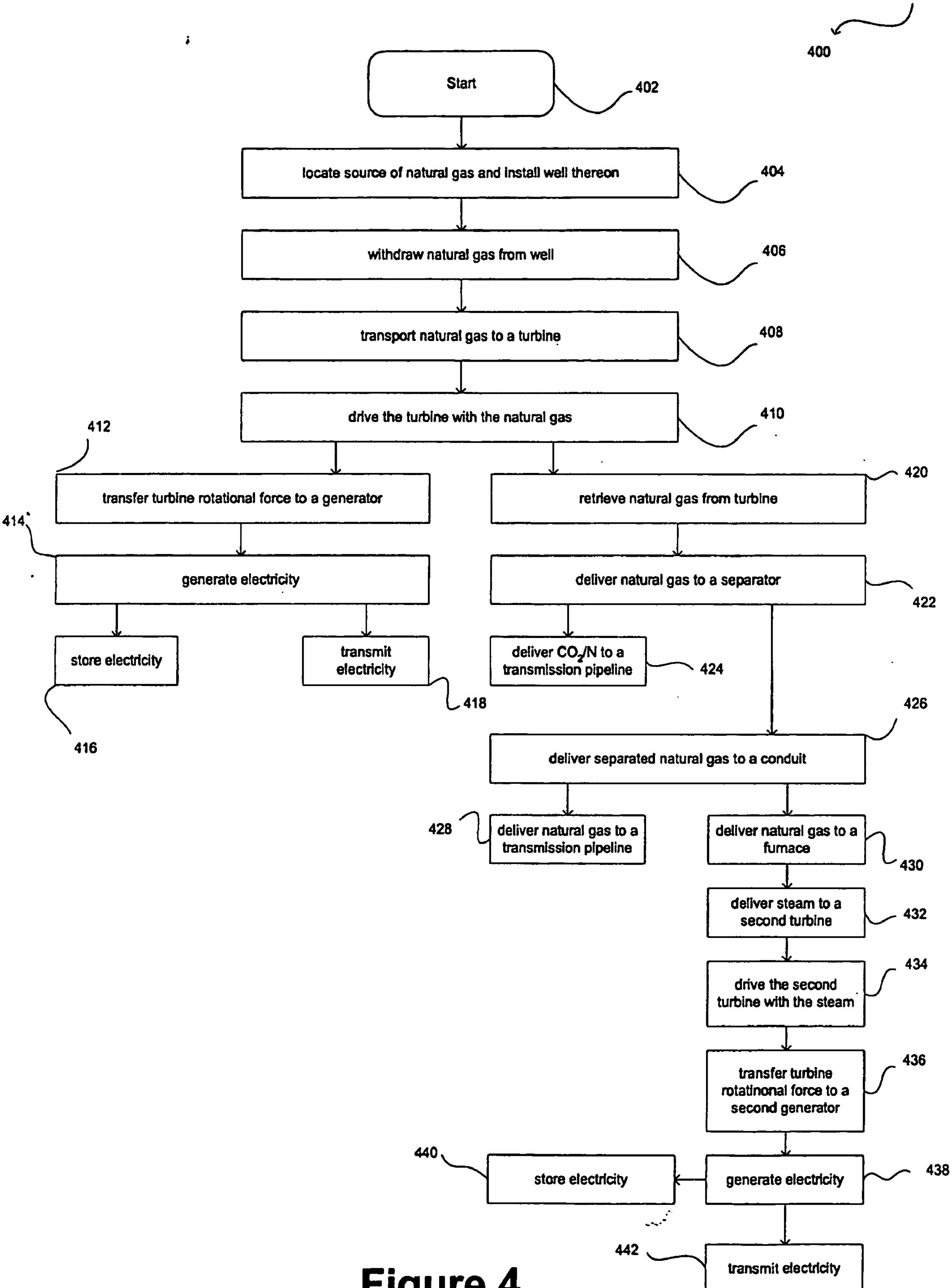

400
Start
402
locate source of natural gas and install well thereon
404
withdraw natural gas from well
406
transport natural gas to a turbine
408
drive the turbine with the natural gas
410
412
transfer turbine rotational force to a generator
414
generate electricity
store electricity
416
transmit electricity
418
retrieve natural gas from turbine
420
deliver natural gas to a separator
422
deliver CO_2/N to a transmission pipeline
424
deliver separated natural gas to a conduit
426
428
deliver natural gas to a transmission pipeline
deliver natural gas to a furnace
430
deliver steam to a second turbine
432
drive the second turbine with the steam
434
transfer turbine rotatinonal force to a second generator
436
440
store electricity
generate electricity
438
442
transmit electricity

Figure 4

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US04/035200

International filing date: 22 October 2004 (22.10.2004)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/549,380
Filing date: 02 March 2004 (02.03.2004)

Date of receipt at the International Bureau: 13 December 2004 (13.12.2004)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)